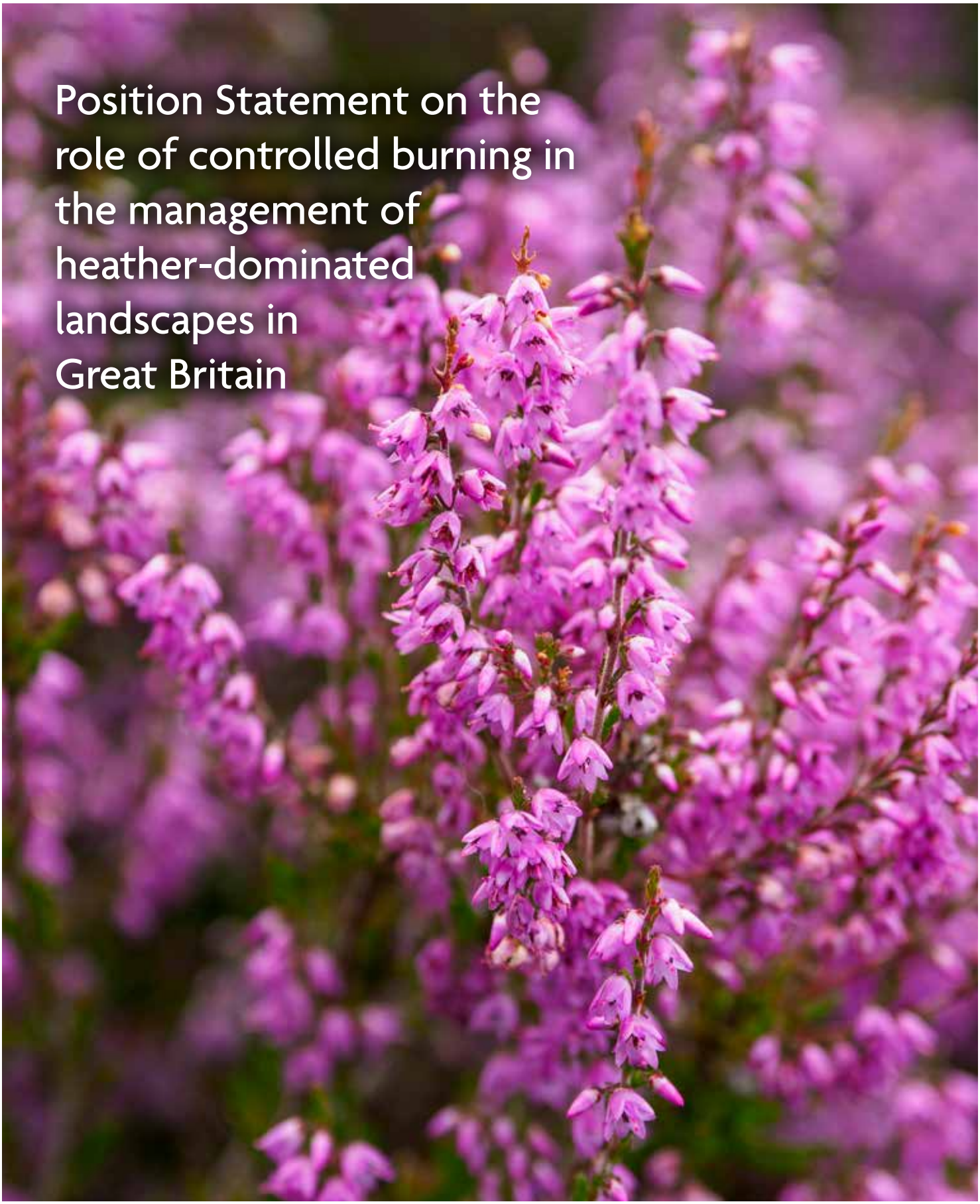
FLF
Future Landscapes Forum

Position Statement on the role of controlled burning in the management of heather-dominated landscapes in Great Britain



www.futurelandscapesforum.com

WHO ARE WE?

The Future Landscapes Forum is a group of academics and practitioners with specialist knowledge of the management, ecology, functioning and fire risk associated with heather-dominated landscapes in the UK. These landscapes are recognised as globally significant, supporting unique habitat and species assemblages (Bain et al., 2011). Many of us have conducted key research and published a considerable body of recent peer-reviewed science and assessments pertaining to this important habitat. Our shared views represent a collective body of current, evidence-based science and best practice about managing the UK's heather-dominated landscapes to protect life and property, enhance ecosystem functioning and preserve a globally-important habitat.

Why are we speaking out?

As a group of leading scientists and practitioners in upland management and socio-ecological impacts, we have growing concerns that the public and policy debate about managing heather moorland is neither properly informed nor evidence-based (Davies et al., 2016a). Indeed, there seems to be a concerted effort to derail an evidence-based approach and sound future policy by certain influential organisations and individuals who ignore or distort evidence, often present unevidenced arguments, or deploy arguments based on selective elements of scientific papers and reports that support their position (Ashby & Heinemeyer, 2021). Such arguments are often reductive, lack context and are presented wrongly as the scientific consensus (Ashby & Heinemeyer, 2021).

We believe that debate and, increasingly, decisions about upland management have become polarised and overly focused on a single issue: driven grouse shooting. Our view is that this focus is wrong and dangerous. Our concerns are not related to habitat management for grouse; indeed, we would be making this position statement if grouse, and grouse shooting, did not exist.

We have three aims in relation to heather management:

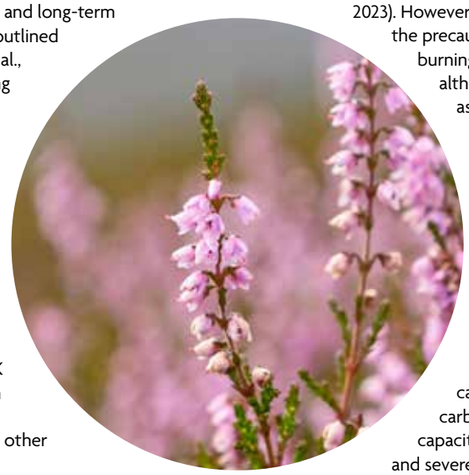
1. To reduce the risk of wildfires that pose a danger to life and property;
2. To support and ideally increase the capture of carbon across large areas of the landscape currently dominated by heather;
3. To maintain and, if possible, improve the biodiversity and other ecological benefits associated with the UK's heather-dominated landscapes.

This position statement offers a short summary of key peer-reviewed research findings and other cited reviews or reports. We have ensured that the evidence we refer to is based on sound science, any statements (or opinions) are substantiated by evidence wherever possible. We intend to invite all stakeholders involved in the policy formation and management of heather-dominated landscapes to meet to discuss the evidence and develop a consensual approach to the management of these globally important ecosystems.

A SUMMARY OF CURRENT EVIDENCE

Reducing the risk of wildfire

Fire has always played an inherent part in the ecology of heathlands and heather-dominated uplands, including on shallow peat and deep peat such as blanket bogs. Charcoal and pollen counts from many peat cores across the UK often indicate historically high heather cover and frequent fire episodes over millennia (e.g. Chambers et al., 2017; Webb et al., 2022). Some peatlands are naturally too wet to support a dense heather (*Calluna*) cover, and as such, do not require any vegetation management. In contrast, other peatlands have been heather-dominated for a long time. It is thus questionable to assume that rewetting alone will ensure a reduction in heather cover and associated wildfire risks everywhere. As Davies et al. (2016a) point out, "it is unclear if burning is the result or cause of increased *Calluna* cover". The role of fire needs to be seen in a broader view than currently presented, both temporally (considering historic and potential future management practices and long-term risks of uncontrolled fires as outlined in a report by Heinemeyer et al., 2023) and spatially (considering site conditions and looking beyond the UK), as discussed by Davies et al. (2016a). However, spatial and temporal variability in site conditions is likely high, influenced by many other factors such as grazing, drainage, climate and topography, and there is no overall analysis available on fire history on UK heather moorlands in relation to vegetation dynamics and impacts on carbon storage or other ecosystem functions.



Expert practitioners, firefighters and academics are becoming increasingly concerned about the potential impacts of rising fuel loads in our uplands due to a cessation of vegetation management (Belcher et al., 2021), especially considering climate change predictions (Barber-Lomax et al., 2022). Regional Fire and Rescue departments are firm in their view that allowing heather fuel loads to build up not only increases the risk of wildfire but also makes their job of controlling wildfire much harder (see Barber-Lomax et al., 2022). The recent appointment of a national Wildfire Manager by Fire and Rescue departments in Wales is a clear demonstration of this view. Although controlled burning (sometimes known as low intensity 'cool burning' or 'muirburn', a management practice increasingly taught to fire fighters) will not in itself prevent wildfires from occurring, by reducing fuel loads, it can likely slow their progress and reduce their severity, thus lessening the risk to people, wild and domesticated animals, property, infrastructure and upland ecosystems. In many countries, including the USA, it is known that controlled or prescribed fires reduce the severity and potential for the next wildfire in areas where they are used (Arkle et al., 2012), and firefighters know these areas as places where fire activity will be reduced and can use those areas as anchors to try to catch wildfires before they spread (Harris et al., 2021). However, issues around the frequency (Yallop et al., 2006) and the intensity of prescribed fires remain understudied (Davies et al., 2016a).

We are also concerned that the move towards cutting of heather and associated vegetation as a prescribed alternative to controlled burning is taking place without sufficient scientific study to compare the risks and benefits of each treatment. For peatlands, less is known about the impacts of cutting (some likely negative) than the impacts of burning (Heinemeyer et al., 2019, 2023). However, organisations seem to apply the precautionary principle only to burning (Ashby & Heinemeyer, 2021) although cutting of heather and associated vegetation, and other aspects of alternative management, clearly requires further research (Harper et al., 2018). For example, ground-level accumulation of desiccated litter from mowing likely carries an increased risk of ignition of important peat deposits by smouldering (Santana & Marrs, 2014) with potentially catastrophic loss of stored carbon, greatly diminished capacity for future carbon storage and severe ecological consequences of bare and eroding peat. Finally, the claim that rewetted bogs will become fire resilient, a claim that is often made, seems not to be based on any applicable evidence and simply ignores the fact that many peatlands might not offer the necessary water balance to achieve the needed wetness, especially considering climate change (as indicated by model scenarios, Gallego-Sala & Prentice, 2013), topographic impacts and seasonal drought conditions (Ashby & Heinemeyer, 2021). Moreover, wetter areas, as observed in forests, might increase biomass and fuel production and thus increase fire severity (Arkle et al., 2012). However, whilst wetter areas should support more *Sphagnum* moss, likely enhancing resilience to fires, this might equally increase heather growth in all but the wettest areas and the outcome will likely depend on the site conditions, especially the wetness potential. We support rewetting efforts, but we suggest that there are important known unknowns which need to be considered in relation to site specific vegetation composition, fuel

load build-up, limitations for rewetting, and long-term resilience to wildfire of heather dominated moorlands. In addition, the potential impacts of pyro-convection (Dowdy et al. 2019) resulting from moisture releasing latent heat and leading to enhanced convection need to be much better understood.

We further suggest that the issues of upland drainage and overgrazing, once encouraged by UK government grants and headage payments, have been confounded in the evidence base with impacts of heather management by controlled burning. As the UK uplands are predicted to become drier (Barber Lomax et al., 2022), we need to consider all options and combine approaches including rewetting and various vegetation management tools (Belcher et al., 2021); a blanket ban of one management tool might backfire. Sites differ, and a careful, evidence-based approach is needed. Moreover, practitioners' site-specific knowledge and experience should be utilised when we lack the data to implement an evidence-based approach.

Increasing carbon capture and green house gas benefits

When contextualised against wildfire risk, the current published science does not show that controlled burning is detrimental to carbon capture on managed heather peatlands (e.g. Harper et al., 2018). On the contrary, there is a lot of peat-core evidence, modelling studies and newly emerging science to suggest that biochar produced by controlled burning is an effective and thus potentially valuable means of locking up carbon in peatland soils (e.g. Worrall et al., 2013; Leifeld et al., 2018; Heinemeyer et al., 2018). Charcoal has also been linked to reducing the microbial action associated with decay (Flannagan et al., 2020), and the release of greenhouse gases like methane from peatland (Davidson et al., 2019). These biochar effects may also be more effective at capturing carbon when compared to cutting vegetation (Heinemeyer et al., 2019; 2023) and compared to unmanaged litter decomposition (Worrall et al., 2013). Notably, recent debates about the role of charcoal in peatland carbon accumulation are not about the quality of the science but have been based on unfounded accusations about how the science is interpreted, inappropriate use of terminology and misleading model scenarios (Ashby & Heinemeyer, 2021) about drainage (Young et al., 2019, 2021). Moreover, unmanaged, ageing heather on blanket bogs seems to dry out the peat, stimulating decomposition and likely reducing the net carbon uptake, whilst alternative heather cutting seems to increase sedge cover with likely increased methane emissions (Heinemeyer et al., 2023). However, whilst an increased *Sphagnum* cover might buffer against these effects (e.g. Larmola et al., 2010), we lack understanding about where this is possible and how all these findings relate to heather-dominated shallow peat soils.

Maintaining biodiversity

The UK's heather-dominated landscapes are semi-natural habitats that have been shaped by human disturbance regimes for centuries. Spatially and temporally heterogeneous land-use practices, such as cutting, burning, and grazing, have resulted in complex mosaic landscapes that are of high priority for conservation in Europe. In fact, such open landscapes are likely to represent a climax vegetation community (Fenton, 2023). Contemporary conservation practices subject these systems to management regimes that are generally less diverse, in terms of disturbances and fine-scale temporal and spatial variability, than traditional land use, but the ecological consequences of these simplifications are unclear (Vandvik et al., 2005). Our assessment of the current scientific literature shows that controlled burning, if conducted properly, can maintain heather communities with a varied age-structure resulting in a greater diversity of flora and fauna on a landscape scale compared with a cessation of vegetation management. The overall positive role of fire also supports this view in a global assessment of terrestrial vertebrate richness patterns (Moritz et al., 2022). The little evidence available for UK peatlands does not support the claims that unmanaged blanket bogs transition to 'intact' bogs with increased plant biodiversity. On the contrary, even after more than 60 years, a comparison at Moor House shows clear benefits on plant biodiversity of burning, with increased 'peat-forming' species, versus no management with heather dominance (Milligan et al., 2018). In addition, other biodiversity benefits of heather management (e.g. birds) are highlighted in a report by Heinemeyer et al. (2023). However, we need more long-term evidence, especially when considering shallow peat soils and the possible development of scrub or forest cover. Again, we stress the need to move away from the precautionary principle and towards an adaptive management approach to prescribed burning and alternative management regimes, such as mowing, rewilding, rewetting and a cessation of heather management. At the same time, we should begin gathering more robust scientific evidence for all heather management options.

CONCLUSIONS

- There is no clear evidence nor a scientific consensus to support a blanket ban on controlled burning. Rather there is an urgent demand for a cautious and adaptive management approach in light of available evidence and knowledge gaps.
- There is insufficient science related to the impacts of alternatives to controlled burning as part of a management regime. We simply do not have the evidence to say that cutting, rewilding, rewetting or a cessation of vegetation management are better at reducing the risk of wildfires, capturing carbon and maintaining biodiversity. On the contrary, the existing evidence is that controlled burning can contribute to delivering our three aims[1] in specific contexts.
- Policymakers should be wary of highly selective evidence presented by "lobbyists" (Davies et al., 2016b,c). Policymakers must challenge the single-issue-based nature of some views in this debate, considering relevant studies from around the world. We strongly recommend an adaptive management approach (Holling, 1978; Gillson et al., 2019) to policy making in this important area.
- We support regulations to steer practitioners toward good standards of controlled burning and experimentation to explore effective alternatives, supported by guidelines that are as well-informed as current scientific evidence and practical experience permits.
- We recommend that policymakers build better and broader communication links with those leading research into the management of the UK's heather-dominated landscapes.
- Much of the UK's uplands have been given national and international special conservation designations partly because past management has promoted the conditions supporting these habitats and species.
- We believe that judgements on the management of heather-dominated landscapes should be made according to all the available scientific evidence, uninfluenced by positions on grouse shooting.
- Finally, issues of assessing and considering limitations of experimental design and monitoring time scales, and in data analysis and generalisation of studies (and previous reviews thereof), need to be a crucial component of any future evidence assessment linked to policy recommendations.

[1]To reduce the risk of wildfires; to support and ideally increase the capture of carbon; to maintain and, if possible, improve biodiversity and ecological benefits of heather-dominated landscapes

REFERENCES

Arkle R.S., Pilliod D.S.& Welty J.L. (2012) Pattern and process of prescribed fires influence effectiveness at reducing wildfire severity in dry coniferous forests. Forest Ecology and Management, 276:174-184. http://dx.doi.org/10.1016/j.foreco.2012.04.002

Ashby M.A. & Heinemeyer A. (2021) A critical review of the IUCN UK Peatland Programme's "Burning and Peatlands" Position Statement. Wetlands, 41:56. https://doi.org/10.1007/s13157-021-01400-1

Bain C.G. et al. (2011) IUCN UK Commission of Inquiry on Peatlands. IUCN UK Peatland Programme, Edinburgh. https://www.iucn-uk-peatlandprogramme.org/resources/commission-inquiry

Barber-Lomax A., Battye R., Gibson S., Castellnou M., & Bachfischer M. (2022) Peak District National Park Wildfire Risk Assessment. https://www.peakdistrictwildfire.co.uk/

Belcher C.M., Brown I., Clay G.D., et al. (2021) UK wildfires and their climate challenges. Expert Led Report Prepared for the third Climate Change Risk Assessment. https://www.ukclimaterisk.org/wp-content/uploads/2021/06/UK-Wildfires-and-their-Climate-Challenges.pdf

Chambers F., Crowle A., Daniell J., et al. (2017) Ascertaining the nature and timing of mire degradation: using palaeoecology to assist future conservation management in Northern England. AIMS Environmental Science, 4(1):54-82. https://doi.org/10.3934/environsci.2017.1.54

Davidson S.J., Van Beest C., Petrone R. & Strack M. (2019) Wildfire overrides hydrological controls on boreal peatland methane emissions. Biogeosciences, 16:2651-2660. https://doi.org/10.5194/bg-16-2651-2019

Davies G.M., Kettridge, N., Stoof, C.R., et al. (2016a) The role of fire in UK peatland and moorland management: the need for informed, unbiased debate. Phil Trans Royal Soc B, 371:20150342. https://doi.org/10.1098/rstb.2015.0342

Davies, G.M., Kettridge, N., Stoof, C.R., et al. (2016b) The peatland vegetation burning debate: keep scientific critique in perspective. A response to Brown et al. and Douglas et al. Philosophical Transactions of the Royal Society B: Biological Sciences, 371, no. 1708, 20160434. https://doi.org/10.1098/rstb.2016.0434

Davies G.M., Kettridge N., Stoof C., et al. (2016c) Informed debate on the use of fire for peatland management means acknowledging the complexity of socio-ecological systems. Nature Conservation, 16:59-77. https://doi.org/10.3897/natureconservation.16.10739

Dowdy, A.J., Ye, H., Pepler, A. et al. Future changes in extreme weather and pyroconvection risk factors for Australian wildfires. Sci Rep 9, 10073 (2019). https://doi.org/10.1038/s41598-019-46362-x

Fenton J.H.C. (2023) The Role of Grazing in Maintaining Open Landscapes in Temperate Regions. Int J Environ Sci Nat Res 31(3): 556320. https://juniperpublishers.com/ijesnr/IJESNR.MS.ID.556320.php

Flanagan N.E., Wang H., Winton S. & Richardson C.J. (2020) Low-severity fire as a mechanism of organic matter protection in global peatlands: Thermal alteration slows decomposition. Global Change Biol, 26:3930– 3946. https://doi.org/10.1111/gcb.15102

Gallego-Sala, A. & Prentice, C. (2013) I. Blanket peat biome endangered by climate change. Nature Clim Change, 3:152–155 (2013). https://doi.org/10.1038/nclimate1672

Gillson, L., Biggs, H., Smit, I. P., Virah-Sawmy, M., & Rogers, K. (2019). Finding common ground between adaptive management and evidence-based approaches to biodiversity conservation. Trends in Ecology & Evolution, 34(1):31-44. https://doi.org/10.1016/j.tree.2018.10.003

Harris, L.B., Drury, S.A., Farris, C.A. & Taylor A.H. (2021) Prescribed fire and fire suppression operations influence wildfire severity under severe weather in Lassen Volcanic National Park, California, USA. International Journal of Wildland Fire, 30(7): 536-551. https://doi.org/10.1071/WF20163

Harper A.R., Doerr S.H., Santin C., Froyd C.A. & Sinnadurai P. (2018) Prescribed fire and its impacts on ecosystem services in the UK. STOTEN, 624:691–703. https://doi.org/10.1016/j.scitotenv. 2017.12.161

Heinemeyer A., Vallack H.W., Morton P.A., et al. (2019) Restoration of heather-dominated blanket bog vegetation on grouse moors for biodiversity, carbon storage, greenhouse gas emissions and water regulation: comparing burning to alternative mowing and uncut management. Final BD5104 Report to Defra; SEI, University of York, UK. https://sciencesearch.defra.gov.uk/ProjectDetails?ProjectId=17733

Heinemeyer A., David T. & Pateman R. (2023) Restoration of heather-dominated blanket bog vegetation for biodiversity, carbon storage, greenhouse gas emissions and water regulation: comparing burning to alternative mowing and uncut management. Final 10-year Report to the Peatland-ES-UK Project Advisory Group. DOI: https://doi.org/10.15124/yao-2wtg-kb53

Holling, C.S. (1978). Adaptive environmental assessment and management. New York, USA: John Wiley & Sons.

Larmola, T., Tuittila, E.S., Tiirola, M., et al. (2010) The role of *Sphagnum* mosses in the methane cycling of a boreal mire. Ecology, 91(8):2356-2365. https://doi.org/10.1890/09-1343.1

Leifeld, J., Alewell, C., Bader, C., et al. (2018) Pyrogenic carbon contributes substantially to carbon storage in intact and degraded northern peatlands. Land. Degrad. Dev., 29:2082–2091. https://doi.org/10.1002/ldr.2812

Milligan, G., Rose, R.J., O'Reilly, J. & Marrs, R.H. (2018) Effects of rotational prescribed burning and sheep-grazing on moorland plant communities: results from a 60-year intervention experiment. Land Degradation & Development, 29(5):1397-1412. https://doi.org/10.1002/ldr.2953

Moritz, M.A., Batllori, E. & Bolker, B.M. (2023) The role of fire in terrestrial vertebrate richness patterns. Ecology Letters, 00:1-12. https://doi.org/10.1111/ele.14177

Santana, V.M. & Marrs, R.H. (2014) Flammability properties of British heathland and moorland vegetation: models for predicting fire ignition. J. Environ. Manag., 139:88-96. https://doi.org/10.1016/j.jenvman.2014.02.027

Vandvik, V., Heegaard, E., Måren, I.E. & Aarrestad, P.A. (2005) Managing heterogeneity: the importance of grazing and environmental variation on post-fire succession in heathlands. Ecology, 42:139-149.

Webb, J.C., McCarroll, J., Chambers, F.M. & Thom, T. (2022) Evidence for the Little Ice Age in upland northwestern Europe: Multiproxy climate data from three blanket mires in northern England. The Holocene, 32(5):451-467. https://doi.org/10.1177/09596836221074036

Worrall, F., Clay, G.D. & May, R. (2013) Controls upon biomass losses and char production from prescribed burning on UK moorland. Journal of Environmental Management, 120:27-36. https://doi.org/10.1016/j.jenvman.2013.01.030

Young, D.M., Baird, A.J., Charman, D.J., et al. (2019) Misinterpreting carbon accumulation rates in records from near-surface peat. Scientific Reports, 9:17939. https://doi.org/10.1

Young, D.M., Baird, A.J., Gallego-Sala, A.V., et al. (2021) A cautionary tale about using the apparent carbon accumulation rate (aCAR) obtained from peat cores. Scientific Reports, 11:9547. https://doi.org/10.1038/s41598-021-88766-8

FLF
Future Landscapes Forum

Position Statement on the role of controlled burning in the management of heather-dominated landscapes in Great Britain

www.futurelandscapesforum.com

Ashby MA, Crabbe MJC, Denny S, Heinemeyer A, Marrs RH, Myhill NG, Williams O, (2023) University of York, York UK